

Covered in Section 6...

Section 6 identifies guidance supplementing the preferred design and considerations for various pedestrian construction elements. On-road and off-road pedestrian facilities are covered in this Section, as are mid-block crossings and provisions for special situations like parking lots and underpasses.



Downtown Durham pedestrian plaza.

Section 6. Standards and Guidelines

This section of the *DurhamWalks!* Pedestrian Plan acts as a stand-alone guidance document for the consideration, design, and construction of pedestrian facilities in the City of Durham, North Carolina. This is to be considered as recommended practice only; best practice in the design of pedestrian facilities must obviously be tempered by sound engineering practice that recognizes the site-specific physical constraints of various landscapes as well as cultural and community context.

Guidance on the design of pedestrian facilities has been published by NCDOT (draft, 1997); American Association of State Highway and Transportation Officials (AASHTO, 2004); and the Federal Highway Administration (FHWA, 2002). The recommended guidance herein borrows heavily from these sources and others, and users are encouraged to refer to them for additional information^{1, 2, 3}. The City of Durham has produced design guidance on wheelchair ramps and street specifications that are updated and considered the dominant reference inside the City authority.

Essential Guidance

- New or reconstructed sidewalks shall adhere to all current local, state, and federal standards, *including the provision of ADA-compliant curb ramps* such as those shown in this Guidance.
- The standard sidewalk width outside of a Pedestrian Activity Center is a 5' minimum concrete structure unless otherwise approved by the City of Durham. Sidewalks and pedestrian facilities within a Pedestrian Activity Center will comply with the standards shown herein unless they conflict with adjacent facilities.
- Downtown Design Overlay District standards have special allowances for parking requirements, signage, and streetscaping; these can be found in Durham's zoning ordinances and at: <http://www.durhamnc.gov/departments/planning/zoneord/section5/54.cfm>.
- All new developments and expanded developments shall have sidewalk on at least one face of the abutting edge of the property to intersect with the nearest existing sidewalk or be directly across the street from the nearest existing sidewalk.
- During temporary closures of sidewalk, construction detours will be identified by signs placed at a location closest to the nearest intersecting sidewalk or pedestrian facility in both directions of travel according to the City of Durham and the latest edition Manual on Uniform Traffic Control Devices (MUTCD) as well as ADAAG requirements for temporary pedestrian access. Refer to <http://mutcd.fhwa.dot.gov/> to access the MUTCD.

6.1 On-Road Pedestrian Facilities Design Guidance

Sidewalk Width.

The width of sidewalks should accommodate two persons walking past one another, a width generally perceived to be five feet, at a minimum. In areas of high pedestrian activity, where the sidewalk immediately abuts the street curb, or a more diverse use of the sidewalk, additional width and different paving and streetscaping options should be considered and may be required.

The minimum width of a sidewalk and planting strip shall be as follows:

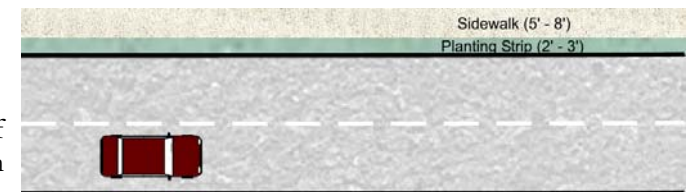
Table 6-1. Minimum Dimensions (feet)

Land Use – Street Type	Sidewalk	Buffer
Central Business District or Pedestrian Activity Center	8	variable
Commercial/Industrial	5	3
Residential – Arterials and Collector Streets	5	3
Residential – Local Streets	5	3

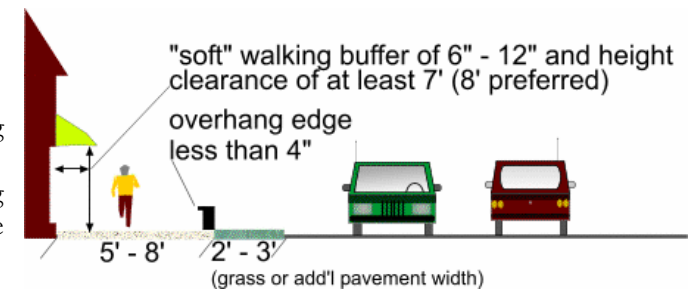
Other circumstances that may require additional sidewalk width are to accommodate the overhang of parked vehicles from off-street or angled on-street parking areas, additional buffer from traffic when a planting strip cannot be installed, and on roadways with transit stops that provide seating or shelter for patrons.

Additional design considerations for on-street sidewalk facilities include the following:

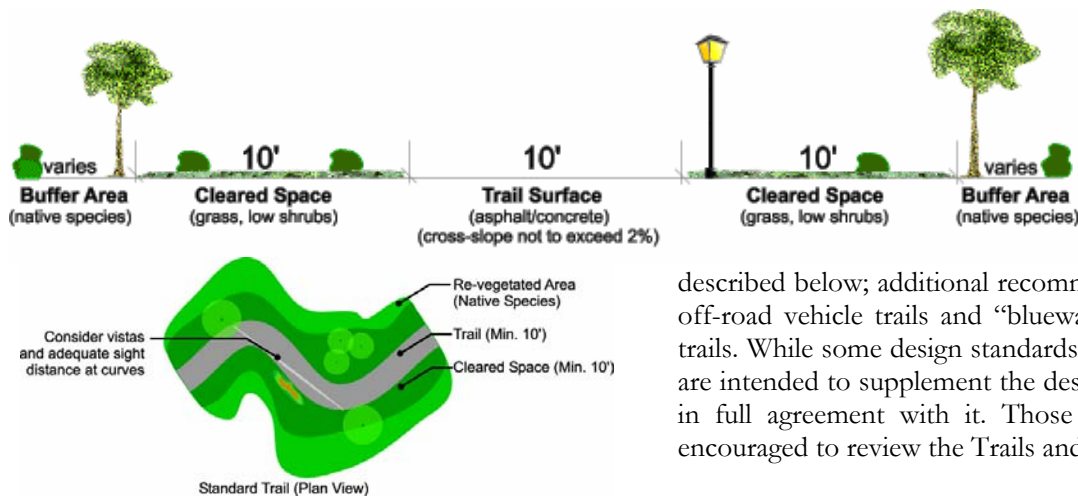
- Eliminating both high and low contact points with tree branches, mast-arm signs, overhanging edges of amenities or furniture, and
- The provision of clear space between walls [on one side of the walkway] and amenities, parking overhang, or plantings on the curb side of the walkway (see diagram at right indicating the relationships between pedestrian features, building faces, and roadway).



Plan View of Sidewalk, Buffer, Street.



Profile View of Sidewalk, Buffer, Street.



6.2 Off-Road Pedestrian Facilities Guidance

The City of Durham has adopted a Trails and Greenways Master Plan⁴ (www.ci.durham.nc.us/departments/planning/pdf/plan_greenway.pdf) that includes a number of design standards. The trail types and general dimensions are

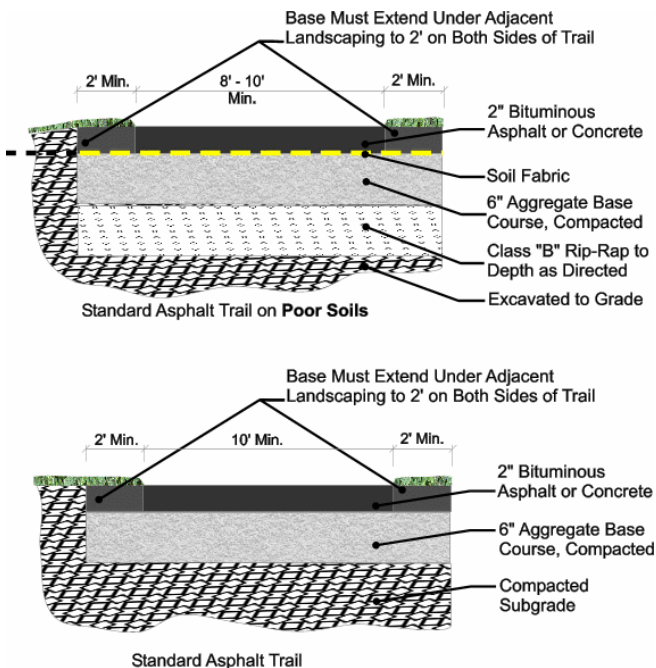
described below; additional recommendations are made in the Trails and Greenways Master Plan for off-road vehicle trails and “blueways,” a term used to describe canoe or kayaking runs or paddle trails. While some design standards are provided, the diagrams shown on this and the following page are intended to supplement the descriptions found in the Trails and Greenways Master Plan, and are in full agreement with it. Those wishing to know more about trail and greenway designs are encouraged to review the Trails and Greenways Master Plan carefully.

Greenway: a system of trails in the City or County, which may be made up of trails, sidewalk trails, and/or recreation trails – example, the North/South Greenway.

Trail: a discrete section of hard-surfaced pathway, generally between major trailheads; a trail may or may not be included in a greenway system and may or may not include a section of sidewalk trail – example, the Third Fork Creek Trail of the North/South Greenway. Trails will be designed for the least possible environmental impact, especially in the County’s Corridor System routes. Refer also to diagrams at left.

Sidewalk Trail Section: 8-to-10 foot wide paved section within or immediately adjacent to a roadway right-of-way; most sidewalk trails are included within a trail and thus do not have a separate name – example, the sidewalk section along Club Boulevard that is part of the South Ellerbee Creek Trail.

Street Trail: a designated connector between trails or greenways, consisting of a standard 5 foot-wide sidewalk and a wide outside lane or bike lane on the roadway – example, Martin Luther King Jr. Parkway between the American Tobacco Trail (ATT) and the Third Fork Creek Trail. Street trails in rural areas may consist of a paved roadway shoulder only without sidewalk or off-road trail section. Generally, street trails are a less-preferred option due to potential conflicts with vehicular traffic on adjacent and crossing streets.



Recreation Trail: an unpaved trail, which may or may not be part of a greenway and can serve for hiking, equestrian use, or mountain biking (example, the New Hope Creek Trail); or a smaller paved trail contained within an urban park.

Street trails are designated pedestrian on-road facilities. The diagram at right is a conceptual drawing indicating key elements of a street trail. Generally, meandering paths are not desirable even where there is sufficient right-of-way to accommodate them, as pedestrians will want to take the shortest path unless they are in a recreational setting.

Recreation Trails by their nature may have limited accessibility to mobility impaired users; other trail types should provide surfaces, grades, and dimensions to make them fully accessible to a wide range of user groups. Cross-slopes should nevertheless not exceed 2% (preferred maximum: 1.5%) to avoid problems with drainage and undercutting of the pavement through erosion. Grade in the direction of travel should not exceed 8.3% according to ADA guidelines (preferred maximum: 5%).

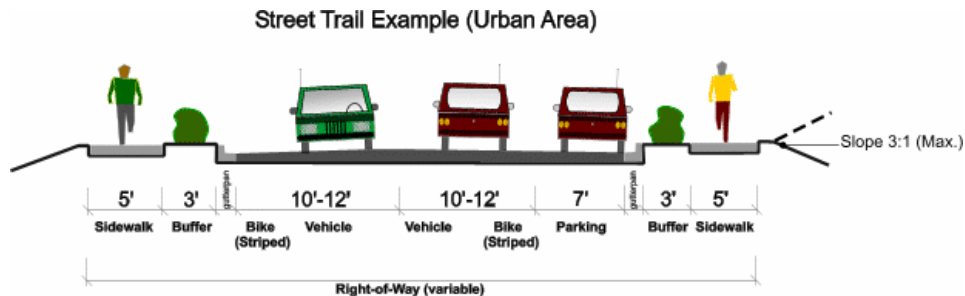
Trail Amenities and Accessibility

Trail amenities should be just as accessible as the trails themselves. Periodic rest areas off to the side of accessible trails are important features as well, and should be level and placed after a long ascent.

Street furniture, lighting, and other amenities can create accessibility problems for those with impaired vision. Overhang should be limited to less than four inches when objects are post- or wall-mounted in the walking space of pedestrians. Special attention should be paid to not locate seating, plantings, or other enhancements in the unloading space that may interfere with the operations of a lift-equipped vehicle. This is also true for opening car doors.

Nevertheless, Durham encourages the inclusion of well-designed streetscaping in its plans. Street trees with deeper rootstock to prevent sidewalk damage; public art; casual – and movable – seating arrangements; textured and colored paving treatments; and ADA-accessible tables are important parts of the design of the street and pedestrian area.

In situations along roadways where wider clear spaces are needed (consult the AASHTO *Roadside Design Guide*, for example), buffer widths and street tree locations will be affected. Care should be



taken, however, to balance the needs of automobiles and drivers alongside those of pedestrians, particularly in areas of high pedestrian activity. Sending a strong message to drivers in these areas that pedestrians have equal access to the street and crossing locations can be achieved by narrowing the roadway, introducing horizontal curvature in the alignment of the street, constructing refuge islands, lowering speed limits, and creating pedestrian-scale lighting, streetscaping, and amenities at the edge of the roadway.



New accessible curb ramp installed on Guess Road.

6.3 Mid-Block Crossings

Mid-block crossings pose special problems for many state and local departments of transportation, since pedestrians will often choose to cross at the location that is the most convenient for them to do so, not necessarily where it is the safest. The Charlotte Department of Transportation has created important research and guidance for assessing alternative treatments at mid-block crossings. This guidance is based, in part, upon the work of FHWA and Charles Zegeer⁵ in examining a number of unmarked and marked mid-block crossings. Zegeer noted that a simple marked crosswalk by itself is often insufficient to provide a good cue to motorists that a pedestrian crossing is in front of them, particularly on roadways exceeding 12,000 – 15,000 vehicles per day (vpd). This is especially true in poor lighting conditions, short sight distance situations, multi-lane crossings, and higher-volume streets. The City of Durham also assumes that pedestrians will be using every street and making crossings, so the question becomes how best to safely accommodate pedestrians in a crossing situation. Figure 6-1 below shows the “solution space” for the four warrants that the Charlotte DOT considers when evaluating a mid-block crossing treatment: traffic volumes, proximity to the nearest signalized crossing, vehicle speeds, and vehicular/pedestrian volumes. When a roadway crossing has all of these factors falling into the ranges suggested by the shaded box in the diagram, then it may meet the criteria for one or more mid-block crossing treatments. Other factors like roadway width



Pedestrian Crossing. *An example of a mid-block crossing in Carrboro, NC.*

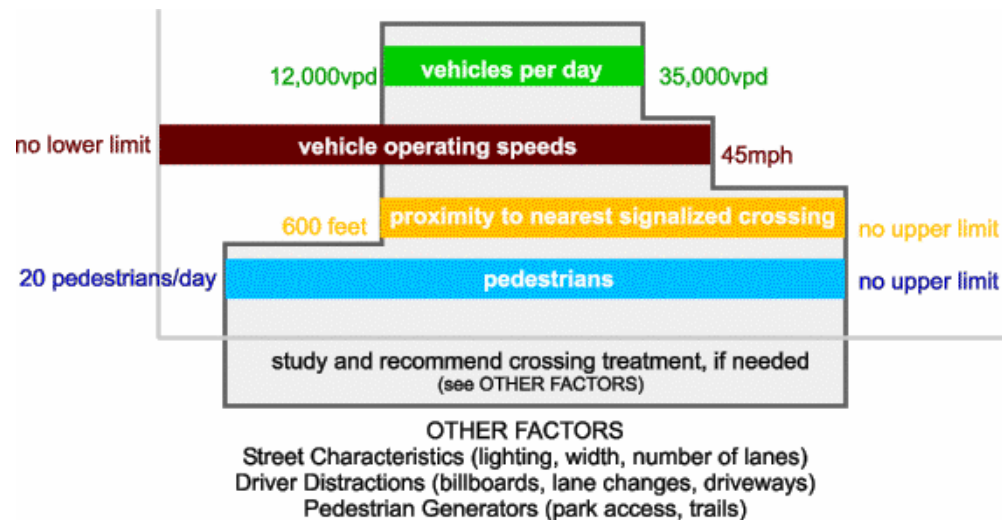


Figure 6-1. Solution space for considering when to apply signalized mid-block pedestrian crossings.

N.C. Pedestrian Crossing Laws

Sections 20-172 through 20-175.2 of the N.C. General Statutes provide important legal considerations when designing and enforcing pedestrian crossing treatments:

- Drivers must yield to pedestrians (or cyclists) crossing a driveway, alley exit, or parking garage exit on a sidewalk. (§20-173)
- Pedestrians crossing any roadway other than at a marked crosswalk must yield to vehicles.
- Pedestrians should cross at street intersections or in marked crosswalks.
- If there are sidewalks, pedestrians are not to walk in the roadway. Where sidewalks are not provided, any pedestrian walking along the roadway will walk to the extreme left, facing in the direction of approaching traffic.
- Every driver must consider pedestrians at all times, especially exercising care in the presence of children or incapacitated persons on the roadway. (§20-174)
- Special emphasis on leaving adequate crossing room at intersections is noted for visually handicapped persons. (§20-175.2)

and presence of a high number of pedestrians will also influence the decision to locate a mid-block crossing and the type of treatment needed to help ensure safe pedestrian crossings. The treatments that Charlotte identified are in Table 6-2, along with costs and operating parameters.

Table 6-2. Mid-Block Crossing Treatment Design Criteria (*Charlotte DOT, 2005*).

**Note: MUTCD recommends pedestrian volumes of at least 400 for a four-hour period. **A HAWK (High-Intensity Activated Crosswalk) signal is a pedestrian-activated system used for high-volume crossings found to be useful in increasing the rate of driver responses to pedestrian crossings, especially in Tucson, AZ where they have been utilized extensively.⁶*

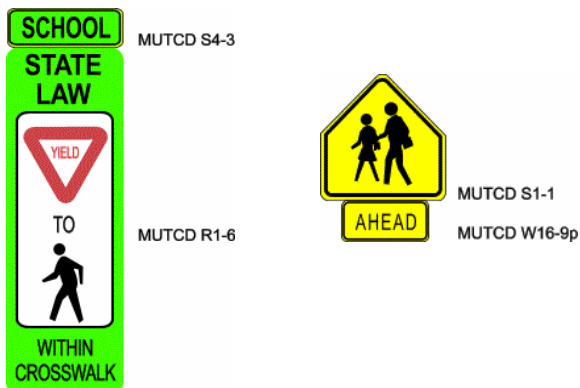
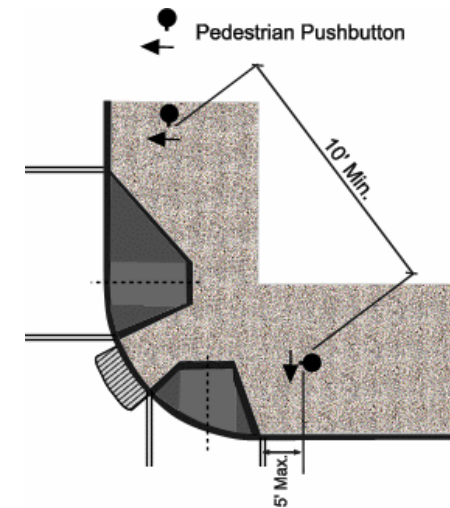
Pedestrian Mid-block Crossing Treatment	AADT	Operating Speed	Approx. Cost
Signs	5,000 – 35,000	Less than 45 mph	\$250 - 350
High-Visibility Markings	5,000 – 12,000	Less than 35 mph	\$500 – 1,500
Colored and Textured Markings	5,000 – 12,000	Less than 35 mph	\$5,000+
Curb Extensions	5,000 – 12,000	Less than 35 mph	\$5,000 – 25,000
Raised Crosswalks	5,000 – 15,000	Less than 30 mph	\$2,000 – 15,000
Refuge Island	12,000 – 30,000	Less than 40 mph	\$10,000 – 40,000
Median	15,000 – 35,000	35 - 45 mph	Varies greatly
In-Pavement Illumination	5,000 – 15,000	Less than 35 mph	\$40,000
Pedestrian-Only Signal*	15,000 – 35,000	35 – 45 mph	\$40,000 – 75,000
HAWK Signal**	15,000 – 35,000	35 – 45 mph	\$35,000 – 60,000

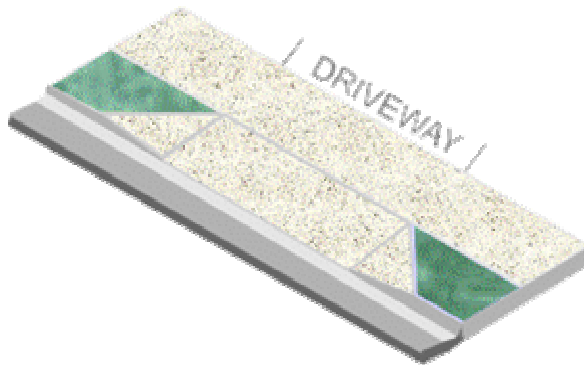
Every mid-block crossing treatment will require a specific investigation by the City of Durham Transportation and Engineering Divisions prior to initiating design and construction. Mid-block treatments can be useful in improving safety in areas with fairly high pedestrian crossings and low numbers of vehicles and vehicle speeds, if located and designed properly.

Pedestrian Crossings and School Zone Treatments

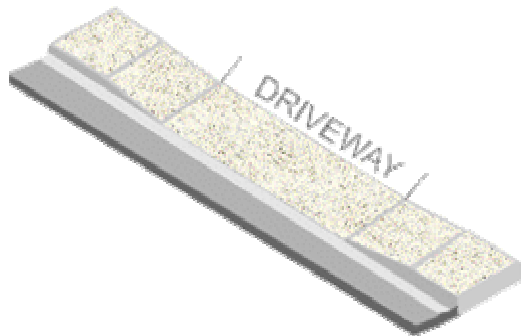
Durham uses national standards to determine crossing treatments, signage, and warrant information, which can be found in the Manual on Uniform Traffic Control Devices (MUTCD). The diagram on this page indicates the appropriate placement and offsets for pedestrian pushbuttons (MUTCD, Figure 4E-2). Two-stage pedestrian crossings of roadways with medians are permitted, and recommended to have a second pedestrian pushbutton in the median, the surface of which should be level or ramped to allow handicapped access through the median. Passive pedestrian detection equipment is becoming more common, and can be recommended in high-volume locations where many pedestrians are crossing a five-lane (or greater) street cross-section. Audible pedestrian signals should be carefully placed to ensure that false readings of the signal are not presented where there is a free-right or “slip” lane, in the presence of complex signal phasing, or other conditions where background noise can interfere with the audible signal.

Section 7 of the MUTCD is entirely devoted to “Traffic Controls for School Areas” and is the dominant guidance available to Durham for installing signs and markings in school zones, and is not repeated here. However, this section provides valuable additional guidance for school crossing treatments that can be utilized for the planning and design of schools that should be considered when making safety improvements. This section, for example, provides a sample School Route Plan Map (Figure 7A-1), which is recommended as a preliminary assessment tool in those areas where there have been numerous complaints and/or pedestrian accidents related to a school. Such a plan would indicate the locations of crossing guards, marked crosswalks, student crossing warning signage (see figure below, right), pedestrian pushbutton activated signals, traffic volumes/speeds, and signal control at all intersections within 1/4- to 1/2-mile of the school. In addition, standards for additional warning signage (see figure below, left) to warn drivers in advance of the upcoming school zone.

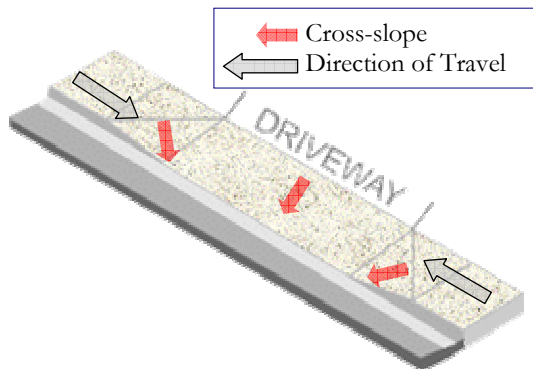




Preferred – The sidewalk is set behind the driveway apron and planting strip.



Conditionally Acceptable – The “dip” at the driveway apron allows for safer passage with no cross-slope.



Not Acceptable – The cross-slope at the driveway apron provides a difficult challenge for a person using a wheelchair or cane.

6.4 Special Features

This section of the Durham pedestrian design guidance provides design criteria considerations on a variety of pedestrian treatments, including the following:

- Americans with Disabilities Act (ADA) compliance, including grade, cross-slope at driveways, and design specifications for curb ramps.
- Underpasses for pedestrian trails.
- Traffic calming that works in conjunction with pedestrian mobility.
- Parking area design for pedestrians.
- Mid-block pedestrian signal installations.

Mobility Impaired Design (Americans with Disabilities Act)

The City of Durham strives to maintain a pedestrian system that is fully accessible to all of its citizens, regardless of individual mobility limitations, and in accordance with the Americans with Disabilities Act of 1990. This is accomplished through design sufficiency as well as recognizing appropriate details that make designs user-friendly. The following is not a comprehensive guide, but offers guidance on a number of critical design details that should be considered when developing portions of the pedestrian system.

ADA: Dealing with Cross-Slope from Driveways

The figures at right indicate the preferred (top), conditionally acceptable (middle), and unacceptable (bottom) design solutions for new driveways as they interface with sidewalks. The intent is to make wheelchair travel safe along the sidewalk without directing the user into traffic through angled (cross) slope designs. Cross-slope on sidewalks should not exceed 2%, preferably not 1.5% where possible.

ADA: Typical Curb Ramp Design

Curb ramps are a significant and required feature of accessible pedestrian transportation systems, and must be designed carefully to fulfill their function and the requirements of the Americans with Disabilities Act. Curb ramps should not have a slope greater than 1:12, meaning that for every foot of travel, the slope should not rise more than one inch. To provide a tactile warning to the visually impaired, raised truncated domes with a color contrast to the background material (typically concrete) should be used, with measurements shown in figure at left.⁷

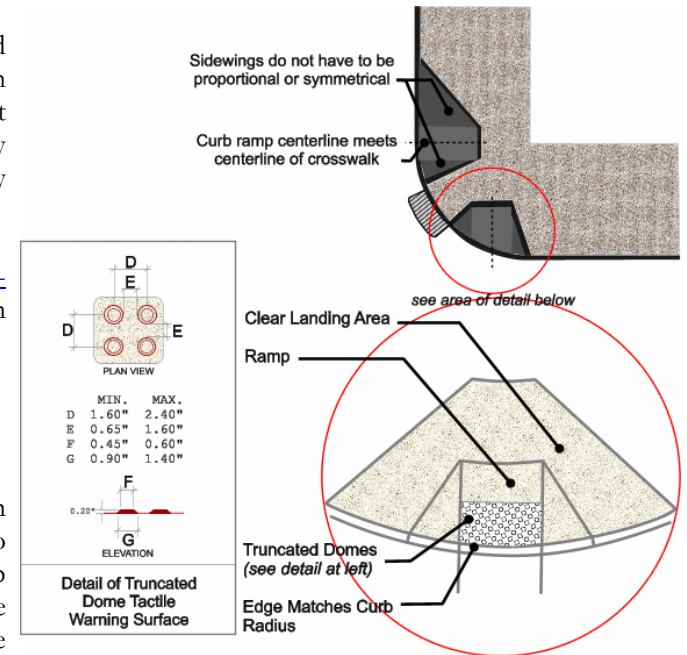
The *ADA Accessibility Guidelines for Buildings and Facilities* (<http://www.access-board.gov/adaag/html/adaag.htm#A4.29.2>) has an easy-to-use format for locating specific design criteria related to curb ramps, rise/run restrictions on ramps, and figures illustrating basic concepts.⁸

ADA: Placement of Curb Ramps

Curb ramps will be placed entirely within the area of the marked crosswalk, so that a pedestrian can enter the ramp space at an angle perpendicular to the direction of travel. The Durham standard is to have separate curb ramps on each corner; if a shared (sometimes called corner or diagonal) curb ramp is constructed, then the width and radius should accommodate the user so that entry onto the ramp is parallel to the direction of travel. The figures below provide examples of the acceptable relationship between crosswalk and curb ramp location/widths.



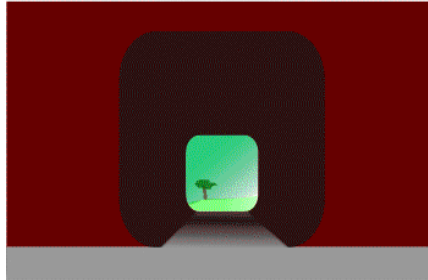
Dual curb ramps (left diagram, preferred) and diagonal ramps. In both cases, the centerline of the pedestrian crosswalk should line up with the curb ramp.



Pedestrian Underpasses

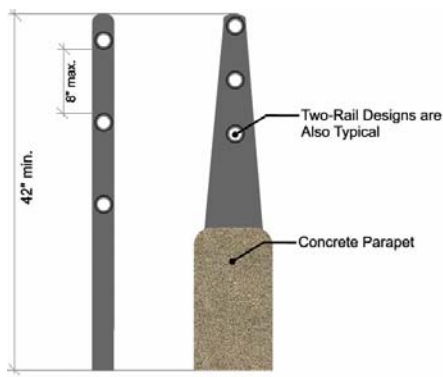
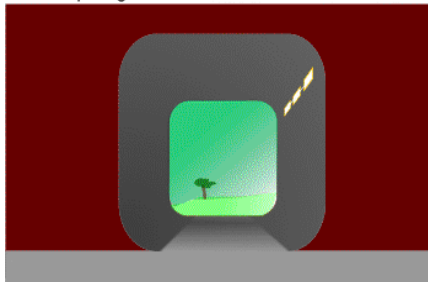
Uninviting Pedestrian Underpass

No Lighting
Openings Should Open Outward
Narrow



Better Pedestrian Underpass

Lighting
Wider Openings/Shorter Traverse



Typical Handrail Specifications On Bridge (Where Sidewalks Exist)

It is often desirable to provide a separated-grade crossing of a major street, sometimes in conjunction with a stream crossing at the same location. Pedestrians are sensitive to uninviting interiors of such crossings, and will not use them if they perceive them to be threatening due to especially long traverses in poorly lit conditions. If the roadway is not elevated, then the openings of the underpass should be flared out to provide clear lines of sight. Minimum widths are 10'-12' for traverses less than 60' in length. Wider widths are suggested for urban areas or longer traverses. Vertical clearances should be a minimum of 8', but 10' is more desirable, particularly if the trail permits equestrian use.

AASHTO provides guidance for lighting in underpasses in their *Roadway Lighting Design Guide*⁹. Providing below-grade crossings must also be dependent on the proximity to floodways: pedestrians should not be put into a situation where they are at risk from rapidly rising flood waters.

Pedestrian Overpasses and Bridges

Sidewalks on bridges may be constructed where the approaching roadway has curb-and-gutter. Sidewalk width is a minimum 5'- 6" (see figure, below) and may not necessarily be constructed on both sides of the facility. Minimum handrail height where there are sidewalk present is 42" although safe cycling height is a minimum of 48" to 54" on downhill slopes (see figure this page).



CURB AND GUTTER APPROACH (from: NCDOT Highway Design Branch Bridge Policy)

Using Traffic Calming Wisely to Promote Pedestrian Mobility and Safety

The City of Durham has a proactive policy to provide safe, on-street environments for vehicular, pedestrian, and bicycle travel. The City conducts and implements several traffic calming studies each year that analyze and recommend appropriate treatments to slow vehicles and discourage high “cut-through” traffic volumes of cars and trucks. Although a complete treatment of traffic calming principles and guidance is beyond the scope of this document, there are a number of principals that should be emphasized during the evaluation, design, and implementation of traffic calming devices:

- The City’s traffic calming policy and program should be clear and strictly adhered to in order to prevent disregard for standard or traffic calming signs, signals, roadway design elements, speed limits, and other features.
- The installation of some traffic calming devices, if inappropriately designed, can impede the safe movement of cyclists, mobility-impaired pedestrians, emergency response vehicles, and some vehicle types such as combination truck-trailers or motorcycles.
- Communities in the area where traffic calming measures are being considered should be consulted and be in near-total agreement on the planning and siting of any traffic calming devices. The shortcomings of the most common and visible traffic calming devices, such as speed humps, street closures, and unwarranted stop controls at intersections (not all of which are used in Durham), need to be carefully documented and considered during the planning and design process. These may include diversion of traffic to other locations, slower emergency vehicle response times, noise level increases, community inconveniences, claims of vehicular damage, disregard of devices in the longer-term, and even speed increases in localized areas.

Sited and designed properly, traffic calming can successfully enhance pedestrian environments. The example at left is a semi-diverter (adapted from FHWA’s *Traffic Calming: State of the Practice*, 1999, page 26) that also restricts cycling on the through street if the new semi-diverters (traffic calming devices in these diagrams are always shown in red line work) are put into place to restrict vehicle movements. Other factors such as the presence of on-street parking, traffic and truck volumes, and drainage returns may strongly influence the appropriateness, effectiveness, location and design of traffic calming devices. Table 6-3 on the following page illustrates the effects of various traffic calming techniques on different user groups.^{10,11}

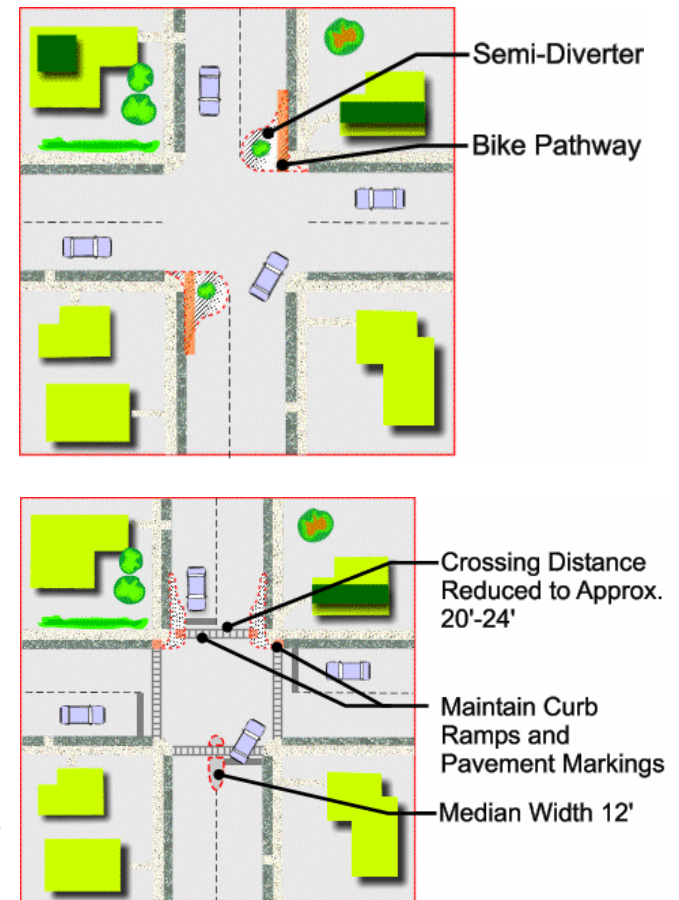


Table 6-3. Traffic Calming Treatments and Potential for Poor Design to Influence Different Groups.

Device/Treatment	Description	B	P	MI	VI
Curb extensions “pinch points”	Curb extensions, planters, or centerline traffic islands that narrow traffic lanes to control traffic and reduce pedestrian crossing distances. Also called “chokers.”	●	•	•	•
Speed tables, raised crosswalks	Ramped surface above roadway, 2 – 3 inches high, 10 – 20 feet long.	•		•	•
Mini-circles	Small traffic circles at intersections.	•	•	•	•
Median island	Raised island in the road center (median) narrows lanes and provides pedestrian with a safe place to stop.			•	•
Channelization islands	A raised island that forces traffic in a particular direction, such as right-turn-only.	•	•	•	•
Tighter corner radii	The radius of street corners affects traffic turning speeds. A tighter radius forces drivers to reduce speed. It is particularly helpful for intersections with numerous pedestrians.	•			
Speed humps	Curved, 2 – 3 inches high, 10 – 20 feet long hump.	•		•	
Rumble Strips	Low bumps across road that make noise when driven over.	•			•
Chicanes	Curb bulges or planters (usually 3) on alternating sides, forcing motorists to slow down.	●			
Roundabouts	Medium to large circles at intersections (Kittelson, 2000).	•	●	•	•
Pavement treatments	Special pavement textures (textured concrete or asphalt) and markings to designate special areas.	•		•	•
Bike lanes	Marking bike lanes narrows traffic lanes.	•			
“Road diets”	Reducing the number and width of traffic lanes, particularly on arterials.	•			
Horizontal shifts	Lane centerline that curves or shifts.	•			•
2-lanes narrow to 1-lane	Curb bulge or center island narrows two-lane road down to one lane, forcing traffic for each direction to take turns.	•			
Semi-diverters, partial closures	Restrict entry/exit to/from neighborhood. Limit traffic flow at intersections.	•			
Street closures	Closing off streets to through vehicle traffic at intersections or mid-block	•			
Stop signs	Additional stop signs, such as 4-way-stop intersections.	•	•	•	•
“Neotraditional” street design	Streets with narrower lanes, shorter blocks, T-intersections, and other design features to control traffic speed and volumes.	•		•	
Perceptual Design Features	Patterns painted or stamped into road surfaces and other perceptual design features that encourage drivers to reduce their speeds.				•
Street Trees	Planting trees along a street to create a sense of enclosure and improve the pedestrian environment.			•	
Woonerf	Streets with mixed vehicle and pedestrian traffic, where motorists are required to drive at very low speeds.	•	•	•	•
Speed Reductions	Traffic speed reduction programs. Increased enforcement of speeding violations.				

B=Cyclist; **P**=Pedestrian; **MI**=Mobility Impaired Person; **VI**=Visually Impaired Person

Traffic Calming Devices and Impacts to Different Design Groups

If poorly designed and/or located, traffic calming measures can have the opposite of the intended effects on the walking environment and potentially the safety of pedestrians.

Key to Symbols in Table:

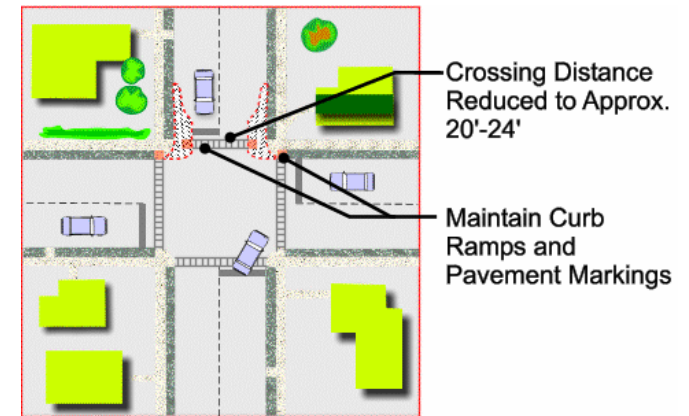
- No Impact to Pedestrians
- Light Potential Impact
- Moderate Potential Impact
- Serious Potential Impact

Curb Extensions (Bulb-Outs) and Curb Radii

The primary purpose of bulb-outs is to shorten the distance that pedestrians must travel to cross a street. In addition, they may encourage motorists to drive slower by narrowing the travel lane and reducing vehicular speeds during turning movements at intersections. Motorists will travel more slowly around corners with smaller curb radii even without the use of curb extensions. Table 6-4 illustrates the relationship between posted speeds and the curb (often called “corner”) radius¹². Landscaping and other aesthetic treatments such as special paving textures should be carefully designed to avoid hazards to drivers and visually-impaired citizens, as well as meet the City’s expectations of controlling long-term roadway maintenance costs.

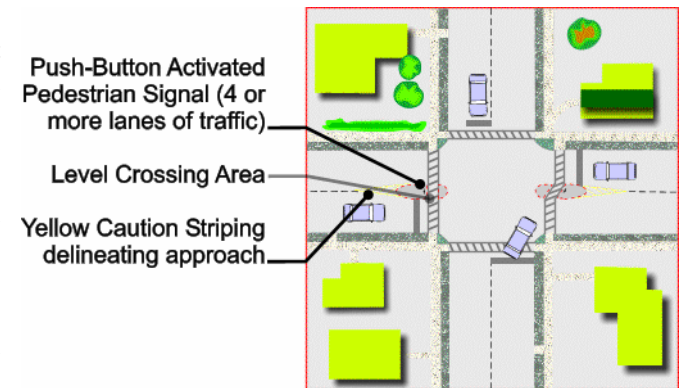
Table 6-4. Maximum Desired Speed and Curb Radii.

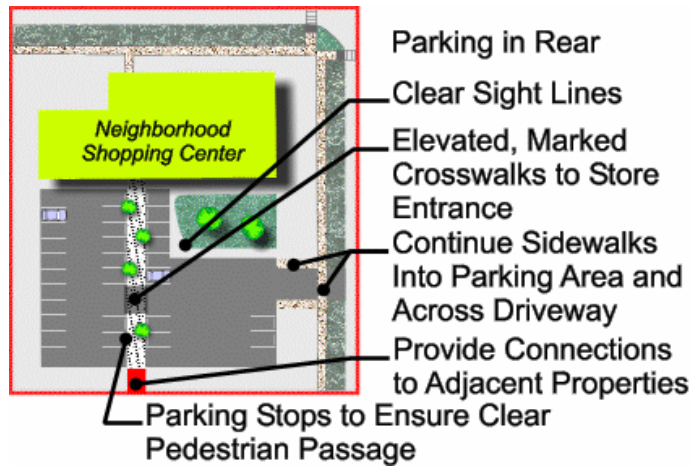
Posted Speed Limit (mph)	Minimum Curb Radius (feet)
Residential Street, 10	10
Residential Street, 15-20	20
Residential Street, 25-30	20-25
Collector Street, 30	30



Medians and Refuge Islands

The graphic at left indicates the design and markings associated with refuge islands. Note that pavement markings delineate the approach to the islands; that the islands are “split” to allow for a level platform for wheelchair use; and that in cases where there are wide roads and high traffic volumes, a push-button pedestrian signal may be mounted in the refuge area to allow pedestrian to split their trip into two halves as they cross the street. Note that the crosswalk on the right side of the diagram is configured at a skewed angle as it crosses the median. This allows pedestrians to have a better angle of sight as they approach and cross each side of the street. In all cases, a minimum 10-foot travel lane is maintained. Sensitivity to large vehicles (buses, trucks and fire equipment) dictates some elements of the median design, curb style, and placement. Median-controlled roadways reduce the number of turning conflicts and are generally preferred for both pedestrians and cyclists over a two-way, left-turn lane (TWLTL) roadway.





Parking Facilities

Everyone becomes a pedestrian once they park their car, but there are many examples of poor parking lot design. The most common design issue is that the primary carriageway for vehicles in the parking lot happens to coincide with where the greatest number of pedestrians is crossing, directly in front of the main entrance. Other issues include poor sight lines to spot pedestrians, bad transition areas from the public domain (e.g., streets) to the private parking area, and inconvenient pedestrian access between parking areas, shops, and adjacent communities. A preferred set of suggestions to overcome these common problems is indicated in the diagram at left. Obviously, as the numbers of cars and pedestrians potentially coming into conflict increases, the more important becomes the issue of treating pedestrian movements carefully. Some suggested treatments:

1. Provide continuous transitions from the street into a safe “landing” area in the parking lot; don’t simply “dump” pedestrians into the throat of a driveway.
2. Maintain good sight lines at major turning points inside the parking area.
3. Whenever possible, provide perpendicular pedestrian access into the front of a high volume land use such as major retail uses. The final crossing to the store entrance(s) should be well-marked, preferably with a raised crosswalk and/or colored demarcations to provide good visual cues to the driver. Moving the main parking aisle away from the principal entrance is another option.
4. Adequate lighting is often perceived as a personal security issue in many large parking areas, and should be provided while avoiding disability glare (looking into a direct light source and being partially blinded) or causing light pollution to adjoining properties. The following table is the recommended horizontal illumination requirements for high-, medium-, and low-level land uses, and should be considered a basic guide based on a majority of lighting policies reviewed.

Intensity of Pedestrian-Oriented Land Use	Average Luminosity (foot-candles)	Minimum Luminosity (foot-candles)
High <i>Civic Centers, Regional Shopping, Fast Food</i>	3.6	0.9
Medium <i>Community Shopping, Office Parks, Hospitals, Apartment Complexes</i>	2.4	0.6
Low <i>Neighborhood Shopping, Churches, Industrial Employee Parking</i>	0.8	0.2

Construction Zones: Providing Adequate Temporary Pedestrian Access

The construction or expansion of roadways, utilities, or private development sometimes requires that sidewalks or trails be temporarily closed to allow for the movement of construction vehicles on and around the site. When pedestrian facilities are closed temporarily, the entity responsible for the construction is also responsible for providing adequate access through or around the site as well as signage that provides advance warning to pedestrians and motorists of the closure. Both the MUTCD (Manual on Uniform Traffic Control Devices)¹³, NCDOT Draft Planning and Designing Local Pedestrian Facilities¹⁴, and the ADA (Americans with Disabilities Act)¹⁵ stipulate that safe passage should be maintained throughout a temporary closure unless it occurs during an extreme situation such as a natural or man-made emergency. During private construction within City limits, it is the responsibility of the City of Durham to ensure compliance with these rules by regular (recommended: daily in high pedestrian areas) monitoring and by the posting of a call-in telephone number to be placed on-site to report potential problems or non-compliance.

The following must be considered by the City, State, or private/public construction agents whenever a sidewalk or trail will be closed temporarily:

- *Accessibility for Mobility Impaired Citizens.* At least one accessible route should be provided to transportation or transit facilities; accessible parking areas/spaces; public streets/sidewalks; and public parking areas to an accessible entrance of the building. This route(s) will comply with all other accessibility provisions contained in the ADA regardless of whether they are temporary or permanent. A barrier shall be placed across the full width of the sidewalk or trail to be detectable by a visually impaired person using a cane. An audible information device may be needed in cases where there are especially high traffic volumes challenging a visually impaired person making a street crossing.
- *Temporary Obstructions.* Parked construction equipment, erosion control fencing, storage of materials/construction debris, and other potential obstructions should be kept away from roadside pedestrian access and pedestrian or multi-use trails so as to keep a permanent passageway open for pedestrians crossing the site. Signs and other devices should not protrude more than 4" into the pedestrian passageway and 7' or less above a sidewalk (8' min. preferred).
- *Advance Warning and Signage.* Advance warning may consist of a single sign to a flashing strobe, depending on the nature of the construction or context (such as vehicular volumes) of the work area. Advance signage should be placed so that pedestrians have an opportunity to read the sign



Poor site access and crossing conditions. Photo from The Louis Berger Group, Inc. (Cary, NC)

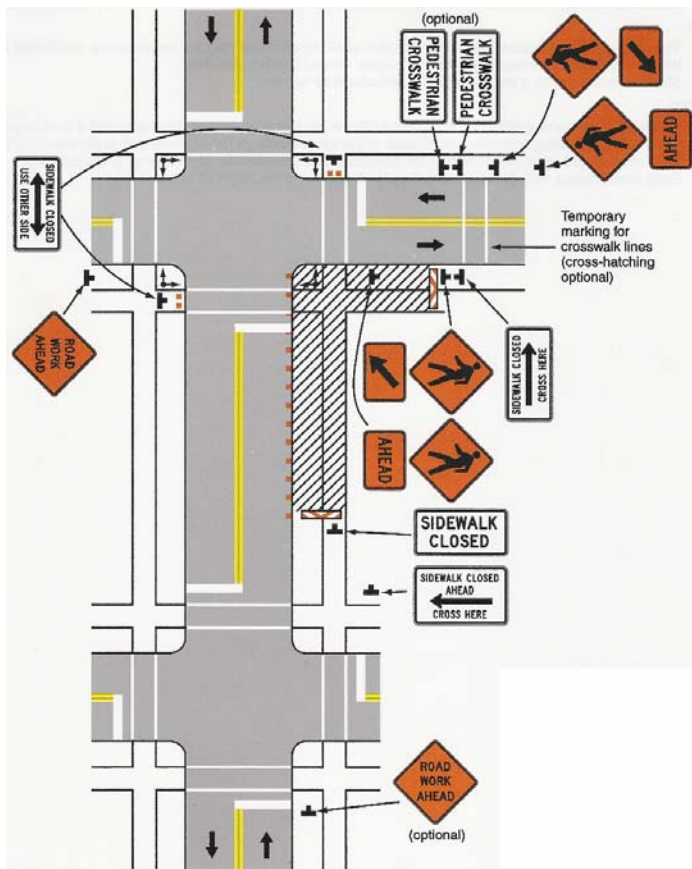


Figure 6-2. Adapted from Sample Signage Plan for Temporary Pedestrian Crossing Closure (MUTCD, Figure 6H-29).

and make a safe crossing at a street intersection to the opposite side of the roadway. (See also Figure 6-2 for additional guidance on signage and placement.) Smaller, mid-block closures will require fewer treatments, but will still retain the “Sidewalk Closed Ahead Cross Street” advance warning at an appropriate and safe crossing point in advance of the closure, at a minimum.

Route Design. Temporary traffic barriers like jersey barriers (although not intermittent short sections) and breakaway bollards should be considered as tools to help delineate a buffer from moving vehicles in areas with high pedestrian traffic volumes and/or to help ensure worker safety. Routes should be smooth and level and maintain the 60" standard width where possible; if not possible, then passing zones measuring a minimum of 60" x 60" will be provided every 200 linear feet. Rumble strips and other warning devices may be considered with professional engineering judgment.

Endnotes

¹ NCDOT, “Planning and Designing Local Pedestrian Facilities (Draft).” North Carolina Department of Transportation Office of Bicycle and Pedestrian Transportation, February, 1997.

² AASHTO, “Guide for the Planning, Design, and Operation of Pedestrian Facilities.” American Association of State Highway and Transportation Officials, July, 2004.

³ FHWA, “Pedestrian Facilities Users Guide-Providing Safety and Mobility.” Federal Highway Administration, USDOT, Publication No. FHWA-RD-01-102, March, 2002.

⁴ Durham City-County Planning Department, Trails and Greenways Master Plan, September, 2001.
(www.ci.durham.nc.us/departments/planning/pdf/plan_greenway.pdf)

⁵ Charles Zegeer, et al, “Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations: Executive Summary and Recommended Guidelines.” (FHWA-RD-01-075) Federal Highway Administration, February, 2002.

⁶ James W. Glock, Letter Correspondence to Regina McElroy, Director, FHWA Office of Transportation Operations, January 11, 2006.

⁷ Vanguard Company, accessed November, 2005
(<http://www.vanguardonline.com/downloads.asp>)

⁸ United States Access Board, ADA Accessibility Guidelines Homepage, accessed November, 2005.
(<http://www.access-board.gov/adaag/html/adaag.htm#A4.29.2>)

⁹ AASHTO, “Roadway Lighting Design Guide.” American Association of State Highway Officials, 2005.

¹⁰ Victoria Transportation Policy Institute, “TDM Encyclopedia” Figure 1 Traffic Calming Strategies and Devices, and The Louis Berger Group, Inc.
(<http://www.vtpi.org/tdm/tdm4.htm>)

¹¹ Walkable Communities, Inc. (<http://www.walkable.org/index.htm>). Note: This site contains a large number of photographic representations of various applications of traffic calming treatments.

¹² City of Durham Public Works “Reference Guide for Development,” Table of Minimum Design Requirements for Public and Private Residential Streets. Rev. October, 2003. Page 154.
(http://www.ci.durham.nc.us/departments/works/handbook/reference_guide.pdf)

¹³ *Manual on Uniform Traffic Control Devices for Streets and Highways*, 2003 Edition. Federal Highway Administration, 2003. Especially Sections 6B-1, 6D, 7, and Figures 6H-28, 6H-29, 7A-1, and 7B-4.

¹⁴ *Planning and Designing Local Pedestrian Facilities*, North Carolina Department of Transportation Office of Bicycle and Pedestrian Transportation. February, 1997, Chapter 10.

¹⁵ Americans with Disabilities Act, US Code 28 CFR Part 36: ADA Standards for Accessible Design. Page 496
(www.usdoj.gov/crt/ada/adastd94.pdf).

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